

WHAT IS CLAIMED IS

1. A heat exchanger for use in a fuel cell system, the heat exchanger comprising:

heat transfer tube elements having an flat passage allowing flow of a cooling medium therein;

outer fins retained between adjacent the heat transfer tube elements allowing flow of a gas there through and

a core formed by laminating the heat transfer tube elements and the outer fins in order; wherein

the gas flows through the outer fins in a direction orthogonal to the direction of cooling medium flow which flows in the passage in each heat transfer tube element; and

a passage in at least a section of the passage for cooling medium provided in each heat transfer tube element comprises a large passage and a small passage group disposed in parallel, the large passage having a large width and being provided upstream to the core with respect to the direction of gas flow, and the small passage group comprising a plurality of small passages being narrower than the large passage and being provided downstream of the core with respect to the direction of gas flow.

2. The heat exchanger as defined in Claim 1, wherein the small passage group is formed by disposing corrugated inner fins in the cooling medium passage.

3. The heat exchanger as defined in Claim 2, wherein the small passage group has a width corresponding to 20 – 40% of the total width of the cooling medium passage.

4. The heat exchanger as defined in Claim 1, further comprising;
an inlet tank connected with the inlet of the cooling medium passage provided on one end of the heat transfer tube elements, and
an outlet tank connected with the outlet of the cooling medium passage provided on the other end of the heat transfer tube elements.

5. The heat exchanger as defined in Claim 4, wherein the inlet tank and the outlet tank are formed in a section of the heat transfer tube elements by a through hole provided in a direction orthogonal to the direction of cooling medium flow.

6. The heat exchanger as defined in Claim 1, wherein the direction of cooling medium flow inverts after flowing through a section of the cooling medium passage from one longitudinal end of the heat transfer tube elements to the other longitudinal end, and flows in the opposite direction to the above by flowing through the other cooling medium passage from one longitudinal end of the heat transfer tube elements to the other longitudinal end.

7. The heat exchanger as defined in Claim 6, wherein an inlet tank connected to the inlet of a section of the cooling medium passage and an outlet tank connected to the outlet of the remaining cooling medium

passage are disposed adjacently on one end of the heat transfer tube elements, and an intermediate tank connected with the entire cooling medium passage is disposed on the other end of the heat transfer tube elements.

8. The heat exchanger as defined in Claim 7, wherein the intermediate tank, the inlet tank and the outlet tank are formed in a section of the heat transfer tube elements by a through hole provided in a direction orthogonal to the direction of cooling medium flow.

9. The heat exchanger as defined in Claim 7, wherein the cooling medium passage connected to the inlet tank is disposed upstream of the core with respect to the direction of gas flow.

10. The heat exchanger as defined in Claim 9, wherein a large passage and a small passage group are disposed in parallel in the cooling medium passage disposed upstream.

11. The heat exchanger as defined in Claim 1, wherein at least one face of the outer fin is coated with a catalyst.